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Notes on the Greek Lymnaeidae (Gastropoda: Basommatophora)

With 43 figures

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Abstract. In 1984–1985, four lymnaeid species were found at 17 freshwater localities in Greece (out of 51 ones at which gastropods were present): *Lymnaea (Radix) auricularia* (LINNAEUS, 1758), *L. (R.) peregra* (O. F. MÜLLER, 1774), *L. (Stagnicola) corvus* (GMELIN, 1788), and *L. (Galba) truncatula* (O. F. MÜLLER, 1774). For each species, the respective localities are listed; descriptions and illustrations are given concerning the shell, pigmentation of the mantle border (in the subgenus *Radix*), and the reproductive organs. Some remarks on the species variability and distribution are presented.

Kurzfassung. **Notizen zu den griechischen Lymnaeidae (Gastropoda: Basommatophora).** – In den Jahren 1984–1985 wurden an 17 Süßwasser-Sammelstellen in Griechenland (von 51 Sammelstellen insgesamt, an denen Gastropoden gefunden wurden) vier Arten der Lymnaeidae nachgewiesen: *Lymnaea (Radix) auricularia* (LINNAEUS, 1758), *L. (R.) peregra* (O. F. MÜLLER, 1774), *L. (Stagnicola) corvus* (GMELIN, 1788), und *L. (Galba) truncatula* (O. F. MÜLLER, 1774). Für jede Art werden die entsprechenden Sammelstellen aufgelistet; beschrieben und illustriert werden die Schale, die Pigmentierung des Mantelrandes (Subgenus *Radix*) und die Genitalorgane. Einige Bemerkungen über die Variabilität der Arten und ihre Verbreitung werden angefügt.

Introduction

Despite the recent progress, the freshwater malacofauna of Greece is still rather poorly known. This concerns the family Lymnaeidae. The scarce records of lymnaeid species in Greece are listed by BUTOT & WELTER-SCHULTE (1994) in their exhaustive bibliography of the Greek malacofauna. Moreover, just all of them report occurrences of snails determined on the basis of shell characters only. On the other hand, as it was demonstrated by ROSZKOWSKI (1914), HUBENDICK (1951), FALNIOWSKI (1980a, b) and numerous other authors, the shell variability within the family is so high that it renders the shell-based determination of species simply unreliable. Thus, the aim of the present paper is to give descriptions of the shell, mantle border pigmentation, reproductive organs, and the distribution of the lymnaeid species collected at 17 localities in Greece in 1984–1985.

Material and methods

Lymnaeid snails were collected in November 1984 – June 1985, at 17 localities in Greece (Fig. 1). The localities are listed below.

- 1 – Lake Koroneia, E of Thessaloniki, the midsouth coast, among macrophytes;
- 2 – the Aliakmon river, by the Athens–Thessaloniki road, to the south of Toikala;
- 3 – at Marathonis, a stagnant pool of a rivulet;

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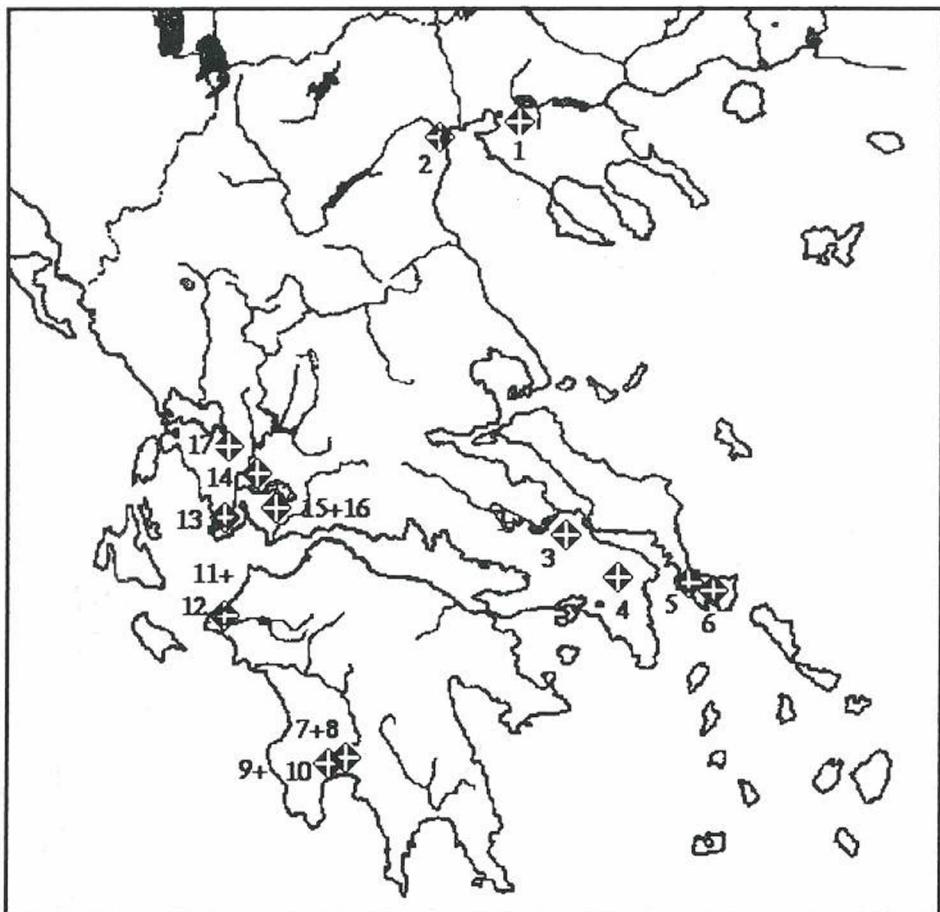


Fig. 1: Map of studied localities.

- 4 - Pikermi - between Athens and Rafina, a brook and a shallow pool, 2 m in diameter;
- 5 - Euboea, at Marmari, to the south of the village, at the seaside, a pool at a water intake on a spring;
- 6 - Euboea, a small spring by the Kalivia-Karistos road, at a monastery;
- 7 - the Pamisos river;
- 8 - at Kalamata, a steened ditch by a road and field;
- 9 - a stream crossing the Kalamata-Messini road, with a clayey bottom and scarce vegetation;
- 10 - a small, steened ditch, to the west of 9, close and parallel to it;
- 11 - Vardolomia, by the Pineios river, a long, steened ditch with practically no water current, at the right-hand riverside;
- 12 - about 3 km to the east of 11, at the left-hand side of the Pineios river, a rivulet with steened banks and a rapid current;
- 13 - the Achelos river, at Neochorion;
- 14 - Lake Lysimachia situated W of Lake Trichonis and connected with the latter by a canal; a huge sample taken by trawling a dragnet from a sandbar between the lakes;
- 15 - Lake Trichonis, trawled at the south coast at Gabalou, at a depth of about 3 m;
- 16 - Lake Trichonis, trawled at the south coast at Gabalou, at a depth of 5-6 m, from the bottom covered densely with *Dreissena*;
- 17 - Lake Ambrakia, to the south of Stanos, the east coast by the Agrionion-Arta main road; collected from the bank.

The gastropods were taken by hand, sieve or dredge, fixed in 4 % formaldehyde, then transferred to 70 % ethanol in which they were kept. The specimens were dissected under a TECHNIVAL binocular; all drawings were done by means of a drawing apparatus. The dissection techniques applied were exactly the same as described in FALNIOWSKI (1980a, b, 1983).

Results

In the studied material, four lymnaeid species were determined (the genus-level systematics and nomenclature after HUBENDICK (1951) and FALNIOWSKI (1980a): *Lymnaea (Radix) auricularia* (LINNAEUS, 1758), *L. (R.) peregra* (O. F. MÜLLER, 1774), *L. (Stagnicola) corvus* (GMELIN, 1788), and *L. (Galba) truncatula* (O. F. MÜLLER, 1774).

Lymnaea (Radix) auricularia (LINNAEUS, 1758)

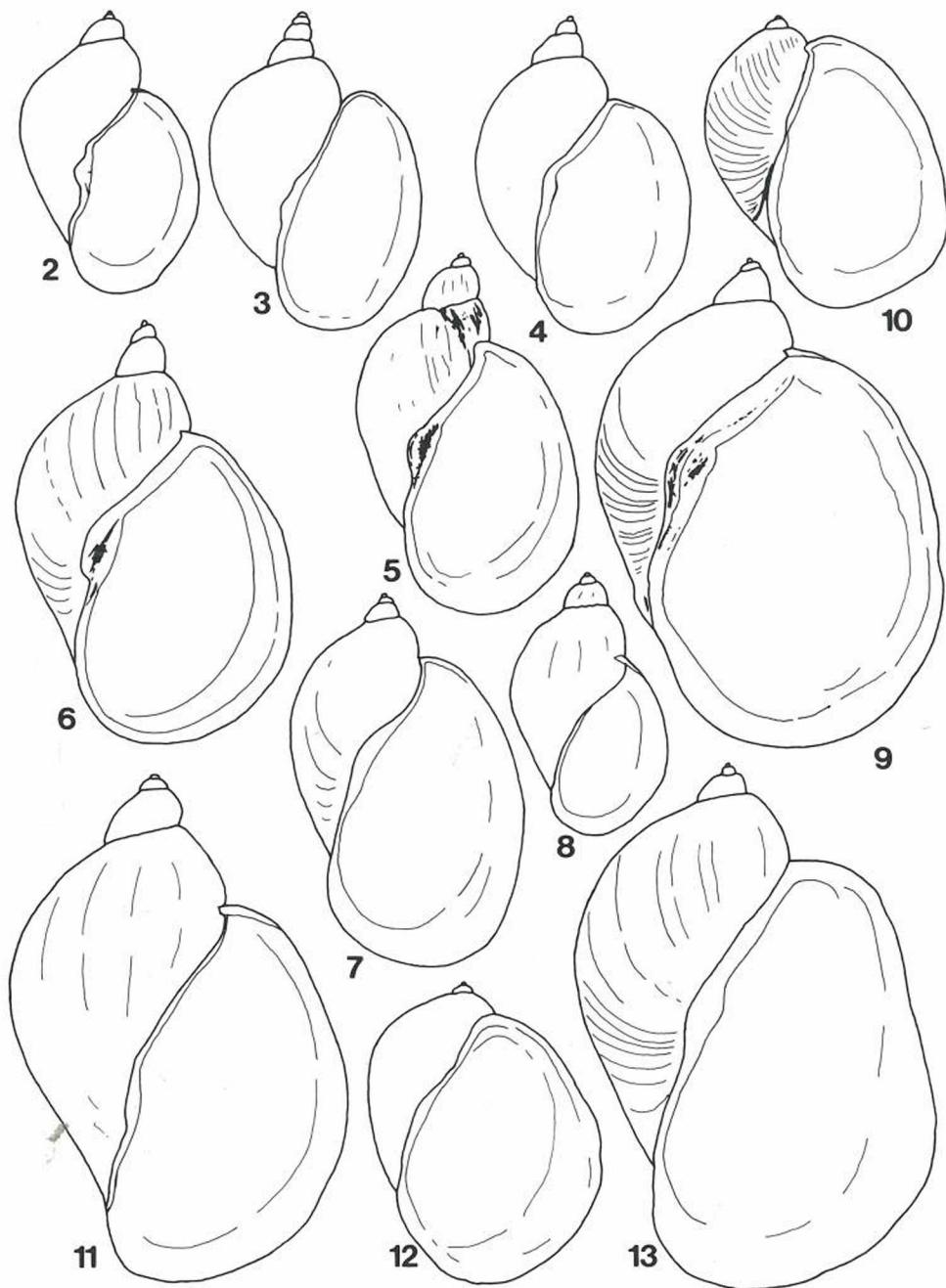
(Figs 2-9, 14-15, 26-32 and 34-39)

Found at localities 1, 7, 8, 9, 10, 11, 12, 13, 14, 17.

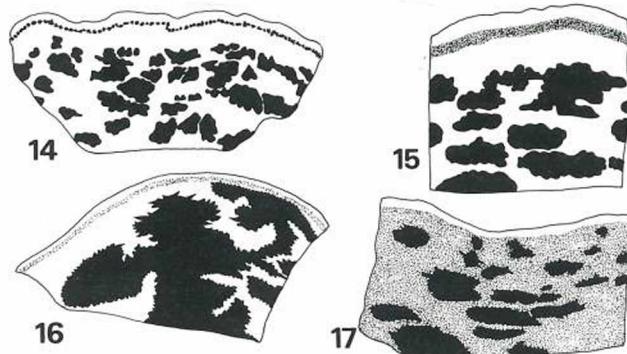
The shells (Figs 2-9) were slightly varied in habitus, with a moderately high spire, within the range of the form *sublagotis* or *subovata*; highly variable in size: in numerous populations only dwarf specimens were found.

FALNIOWSKI (1980b, c) described differences in the pigmentation of the mantle border between *L. (R.) auricularia* and *L. (R.) peregra* in Central Europe. Such differences were found in Greek lymnaeids as well, but not in all cases. Along the margin of the mantle in *Radix* there always is a belt of black pigment, without bigger spots (Figs 14-17). In the Central European *L. auricularia*, in this region there is a strip of black pigment, composed of relatively big, separate, intensively black dots, visible also from the ventral side of the mantle border. This pattern was also observed in some of the Greek specimens (Fig. 14) but not in the majority. Usually the dots the strip consisted of were smaller and less discernible, often also less intensively black, and the strip was broader than in the Central European *L. auricularia* (Fig. 15). The strip was often rather pale and with diluted margins. Sometimes the dots were completely indiscernible, and the strip was then in the form of a slightly darker zone parallel to the mantle border. In all the Greek specimens examined, the strip, even if extremely pale, was visible from the ventral side also, and was often marked better than as seen from the dorsal side. The rest of the mantle was spotted black, the spots covering larger or smaller part of the mantle surface (Figs 14-15). The spots were variable in shape, their borders very slightly denticulate or smooth, like in the Central European specimens.

The reproductive organs (Figs 26-32) were characterized by a broad or very broad (Figs. 26 and 30), usually flat (Figs. 26 and 30-32) albuminoid gland, covering the uterus and nidalment gland and adhering to the pyriform body. The prostate (Figs 26 and 34-39) was unusually flat and embedded in the pyriform body, and uniformly pigmented with black dots. The bursa copulatrix (Figs 26-28 and 30-32) was typical of *L. auricularia*, with a long duct. The outlet of the vas deferens from the prostate (Figs 34-39) was situated typically of *L. auricularia* (FALNIOWSKI 1980b). However, specimens from locality 14 (Fig. 36) differed from the rest of the studied populations in that the outlet of their vas deferens was situated atypically, resembling *L. peregra*. Another difference was in the pigmentation of the praeputium, which in the specimens from locality 14 was very weak, but both the bursa copulatrix and pigmentation of the mantle border were typical of *L. auricularia*. Transverse sections of the praeputium revealed concentrations of dark pigment, which yet were weaker in some specimens. Dorsally, the praeputium was often slightly pigmented. In general, the variability of the reproductive organs was very restricted if compared with the one observed within the Central European populations of the species.



Figs 2–13: Shells of Greek *Lymnaea* (*Radix*): 2–9: *L. (R.) auricularia*: 2 – locality 7, 3 – locality 10, 4 – locality 11, 5–6 – locality 17, 7 – locality 13, 8 – locality 12, 9 – locality 17; 10–13: *L. (R.) peregra*: 10 – locality 16, 11 – locality 2, 12 – locality 15, 13 – locality 14; all the shells drawn to the same scale.



Figs 14–17: Pigmentation of the mantle border, dorsally, of Greek *Lymnaea (Radix)*: 14–15 – *L. (R.) auricularia*: 14 – locality 1, 15 – locality 10; 16–17 – *L. (R.) peregra*: 16 – locality 14, 17 – locality 16.

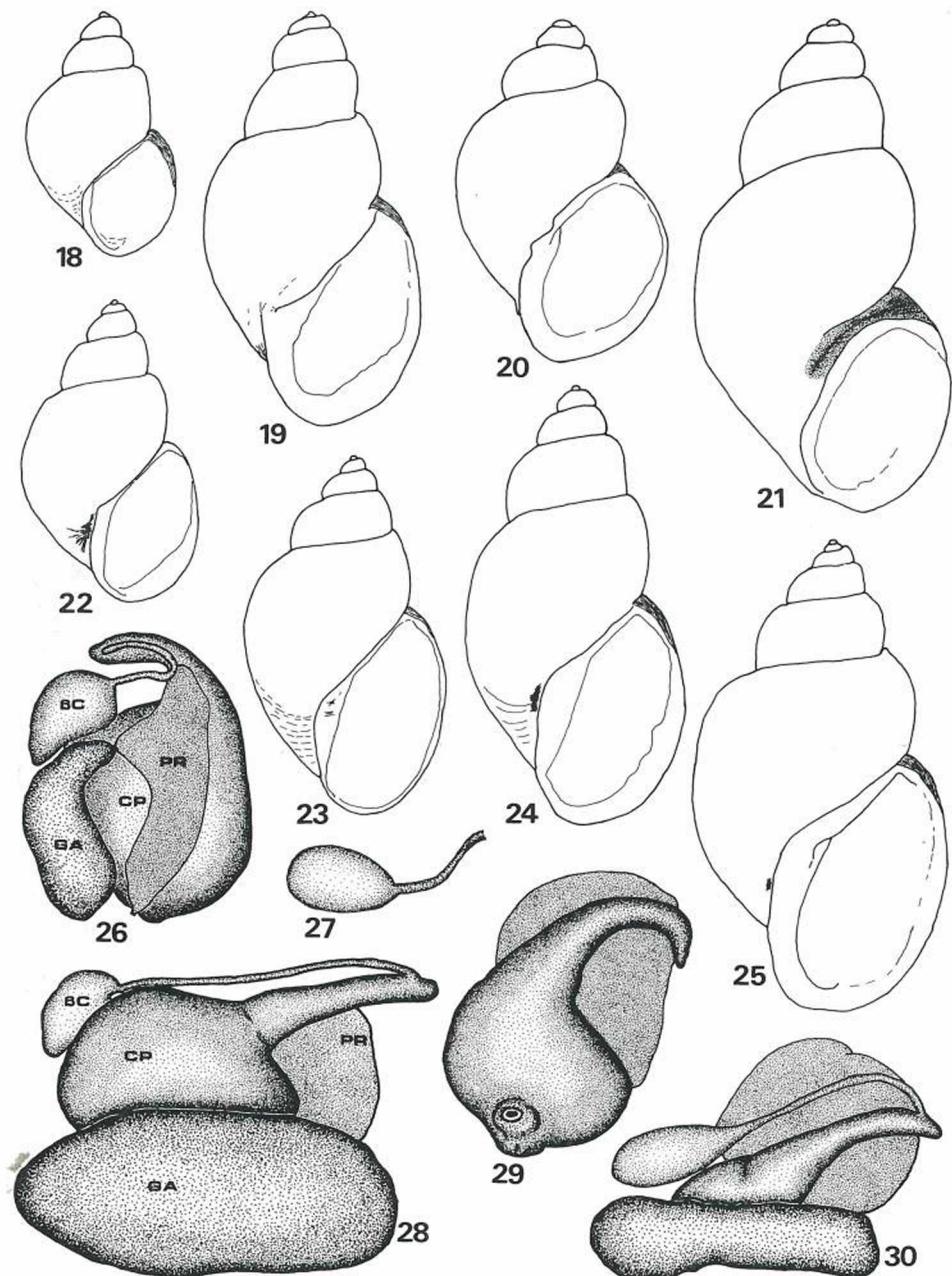
Lymnaea (Radix) peregra (O. F. MÜLLER, 1774)
(Figs 10–13, 16–17, 33 and 40–42)

Found at localities: 2, 14, 15, 16.

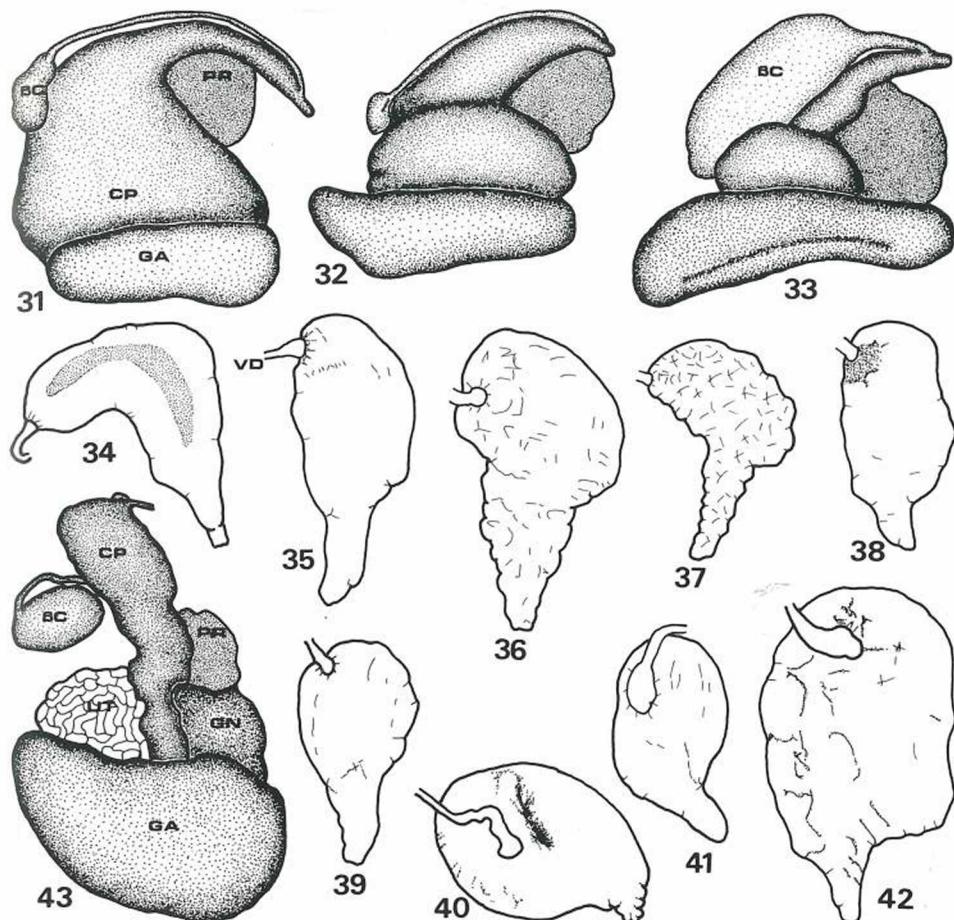
The shell (Figs 10–13) was slightly variable; the spire either low (Figs 10 and 12–13) or moderately high (Fig. 11), within the range of the forms *ovata* or *lagotis*. None representatives of the forms *peregra* or *ampla* were recorded. As in the previous species, some dwarf-shelled populations were found.

The pigmentation of the mantle border described for the Central European representatives of the species is with no strip, or with a slightly marked, diluted strip, which is never visible from the ventral side of the mantle (FALNIOWSKI 1980b, c). The Greek specimens (Figs 16–17) were also either stripless, their mantle border completely pigmentless (in some specimens an evenly distributed, slight pigmentation covered the surface between black spots: Fig. 17), or bearing a delicate and diluted, moderately broad strip (Fig. 16), its colour rather gray than black. The strip, despite its variability, could never be seen from the ventral side of the mantle border, thus its visibility from that side, like in the Central European specimens, proved a good diagnostical character in the Greek gastropods. On the other hand, looked at from the dorsal side, in the majority of the Greek *L. auricularia* the strip resembled rather the picture observed in the Central European *L. peregra*. Thus, in the studied Greek populations, the variability ranges of this character in the two species overlapped. The black spots on the rest of the mantle covered a various part of the mantle surface and were variable in shape (Figs 16–17), but their borders, like in the Central European specimens, were much more denticulate than in *L. auricularia*.

The reproductive organs (Fig. 33), like in *L. auricularia*, were characterized by a very broad albuminoid gland, covering the uterus and nidamental gland and adhering to the pyriform body. Also resembling the latter species, the prostate (Figs 40–42) was extremely flat, embedded in the pyriform body and uniformly pigmented with black dots. The bursa copulatrix was proportionally very big, bulky (Fig. 33), and with a well marked duct, thus the Greek specimens belonged to *L. peregra roszkowskiana* FALNIOWSKI, 1980. The outlet of the vas deferens from the prostate (Figs 40–42) was situated typically of *L. peregra* (FALNIOWSKI 1980b). On transverse sections of the praeputium there were no pigment concentrations. The outer part of the praeputium was unpigmented; in some specimens pigment



Figs 18-30: Shells and reproductive organs of Greek Lymnaeidae: 18-25: shells: 18-24: *Lymnaea (Galba) truncatula*: 18 - locality 2, 19 - locality 3, 20-21 - locality 4, 22 - locality 7, 23 - locality 6, 24 - locality 8; 25 - *Lymnaea (Stagnicola) corvus*, locality 5; all shells drawn to the same scale; 26-30: reproductive organs of *Lymnaea (Radix) auricularia*: 26 - distal part, ventrally, locality 11; 27 - bursa copulatrix, locality 10; 28-30: distal part, dorsally (29 - only corpus pyriformis and prostate): 28 - locality 17, 29-30 - locality 14; BC - bursa copulatrix, CP - corpus pyriformis, pyriform body, GA - glandula albuminoidea, albuminoid gland, PR - prostate.



Figs 31–43: Reproductive organs of Greek Lymnaeidae: 31–42: *Lymnaea (Radix)*: 31–32: distal part, dorsally: 31 – *L. (R.) auricularia*, locality 10; 32 – *L. (R.) auricularia*, locality 11; 33 – *L. (R.) peregra*, locality 14; 34–42 – prostate with outlet of vas deferens, ventrally: 34–39 – *L. (R.) auricularia*: 34 – locality 11, 35 – locality 10, 36 – locality 14, 37 – locality 10, 38–39 – locality 17; 40–42 – *L. (R.) peregra*: 40 – locality 16, 41–42 – locality 14; 43 – *Lymnaea (Galba) truncatula*, distal part, dorsally; BC – bursa copulatrix, CP – corpus pyriformis, pyriform body, GA – glandula albuminoidea, albuminoid gland, GN – glandula nidalmentalia, nidamental gland, PR – prostata, prostate, UT – uterus.

was scattered evenly around, with no concentration on the dorsal side. In general, in this species the reproductive organs were even less variable than in *L. auricularia*; when compared with the variability range observed within the Central European populations of *L. peregra*, within the Greek populations there practically was no variation.

Lymnaea (Stagnicola) corvus (GMELIN, 1788)
(Fig. 25)

The nomenclature within the group "Stagnicola palustris (O. F. MÜLLER, 1774)" discusses FALKNER (1984, 1985).

Only one specimen was found at locality 5 at Euboea Island, as an empty dwarf shell (Fig. 25), it could yet be determined, based on the teleoconch surface sculpture, as described by HUDEC & BRABENEC (1966).

***Lymnaea (Galba) truncatula* (O. F. MÜLLER, 1774)**
(Figs 18–24 and 43)

Found at localities: 2, 3, 4, 5, 6, 7, 8, 10.

The shell (Figs 18–24) was more variable than within the Greek *Radix* species. Parallel to interpopulation size variation also habitus variation was observed, especially in the proportions of the spire, body whorl and aperture, and in the convexity of the whorls. In general, in the examined specimens the whorls were less convex, and the sutures shallower than in a typical *L. truncatula*.

The reproductive organs (Fig. 43) were typical of this species, with a characteristic arrangement of the duct of bursa copulatrix to the bursa (FALNIOWSKI 1980a), and a characteristic habitus of the pyriform body.

Discussion

Freshwater habitats in Greece are relatively scarce, and the majority of them are not permanent, the water level changing throughout a year. Thus, these are not good habitats for molluscs. According to the author's observations, no more than about 30 % of the Greek inland water bodies are inhabited by gastropods. From among 56 (51 fresh- and 5 brackish-water) localities with gastropods in Greece, lymnaeids were present at only 17 freshwater ones (30 %). Thus the family seems to be quite uncommon in Greece. Furthermore, the four species found in the present study is relatively a low number. At 10 localities (59 % of all) there was only one lymnaeid species present, at no one locality I found more than two. The most common was *L. auricularia* occurring at 10 localities (59 % of the localities with lymnaeids, 20 % of all the studied localities with freshwater gastropods); somewhat less common *L. truncatula* inhabiting eight localities (47 % and 16 %, respectively, and much less common *L. peregra* at four localities (24 % and 8 %, respectively); *L. corvus* was found at only one locality.

The shell variability was very restricted for lymnaeids, especially within the subgenus *Radix*, when compared with the Middle European populations (e.g. FALNIOWSKI 1981). This suggests that the studied populations of Greek lymnaeids lived under a rather high environmental pressure and conditions quite different from the optimum. This is also confirmed by the uncommon occurrence of lymnaeids in Greece, as well as by the found several populations of dwarfs. In general, the shells of *L. peregra* in the studied Greek materials resembled more the ones characteristic of *L. auricularia* than of *L. peregra*, although within the subgenus *Radix* the shell characters cannot be used to determine species (FALNIOWSKI 1981).

The anatomical variation was very restricted, as well, but this was accompanied with a rather unusual range of variation; it might be due, more or less, to the genotypic component of the variability. The Greek populations are, in fact, peripheral isolates, thus random genetic sampling followed by genetic drift may have resulted in such a pattern. The unusual habitus of the albuminoid gland, very broad and flat, and of the prostate extremely flat and embedded in the pyriform body, as well as the pigmentation of the mantle border are good examples of such unusual ranges of variation in *Radix*. On the other hand, the reproductive organs were typical in *L. truncatula*.

The atypical prostates found in the specimens of *L. auricularia* from locality 14, resembling the ones typical of *L. peregra* in the localization of the vas deferens outlet, may reflect some degree of interspecific hybridization, since the two species occurred sympatrically at

that locality, but the case remains enigmatic. To the author's knowledge, no case of inter-specific hybridization within the subgenus *Radix* has been recorded. On the other hand, hybridization may occur even between not too closely related species (FALNIOWSKI, KOZIK & SZAROWSKA 1993).

According to FECHTER & FALKNER (1990), *L. auricularia* does not inhabit Peloponnisos, nor it was found by FRANK (1987) at any of her 30 localities scattered on Peloponnisos, some of them very close to the ones considered in the present study. Thus its occurrence at each of the six Peloponnisos localities is noteworthy. On the other hand, the species was found in the Quaternary of the Megalopolis by SCHÜTT et al. (1985), although such shell-based determination is doubtful. In fact, *L. auricularia* is the most common lymnaeid species in Greece, much more common than *L. peregra*. In general, *L. peregra* is more eurytopic than *L. auricularia*, but the latter has a wider geographic distribution (HUBENDICK 1951). In Greece, at the peripheries of its range, *L. peregra* seems less tolerant than *L. auricularia*. *L. truncatula* has been found to be more common in Greece than it is reported in the literature. However, considering the amphibiotic mode of life of the latter species, it seems not surprising that it can inhabit such unstable and semi-permanent habitats.

Acknowledgments

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